The F-22 Helmet Mounted In-Flight Physiological Monitoring System and Beyond

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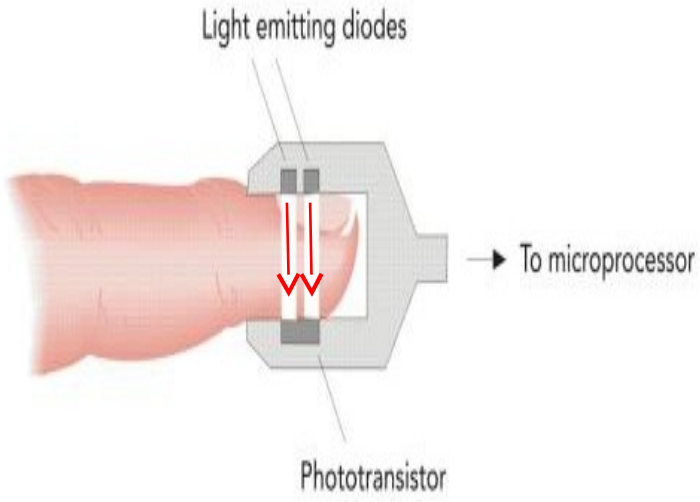
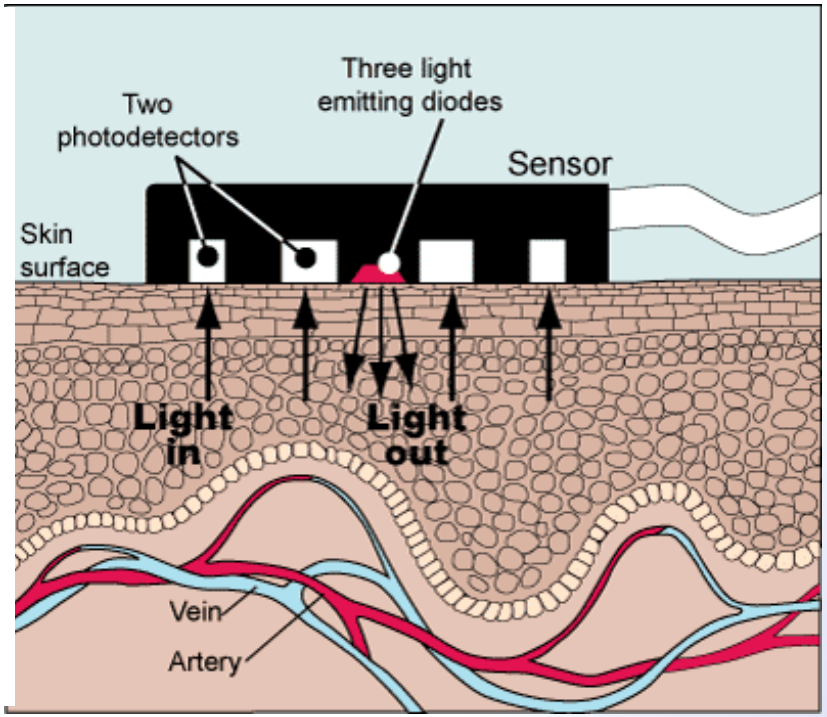
Background

- **16 November 2010, F-22 class A mishap**
- **F-22 pilots are experiencing hypoxic like symptoms in-flight 2010-2011**
- **Raptor fleet grounded for 4 months (Alaska Dispatch | Sep 20, 2011)**
- **Returned to flight – pilots to wear finger pulse oximeter sensor as part of return to flight (477th Fighter Group November 2011)**
- **Finger pulse oximeter data reliability issues**
- **711th HPW develops and tests the helmet mounted pulse oximetry system**

Transmission vs Reflectance

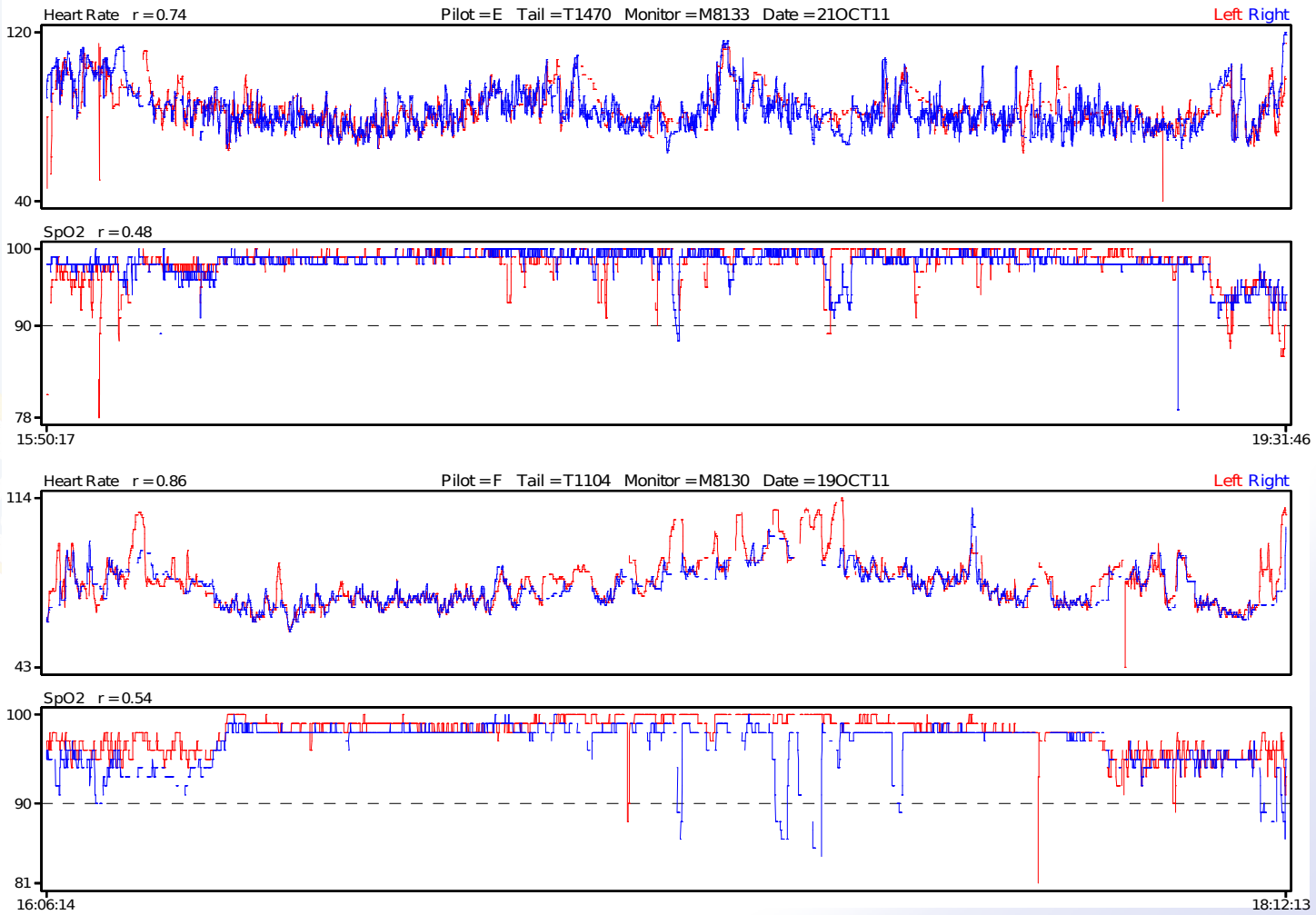




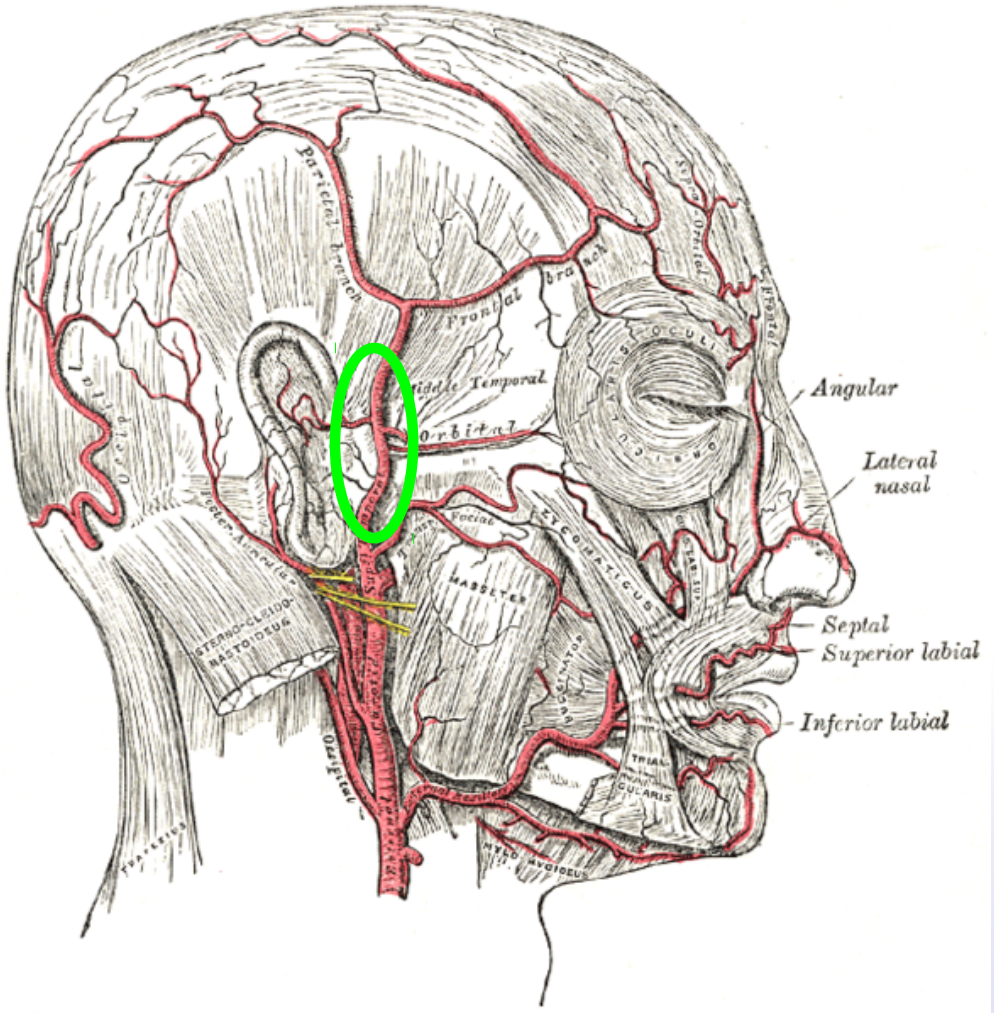
F-22 Uses Wrist Mounted Pulse Oximeter for In-Flight Arterial O_2 Monitoring

- Commercial off-the-shelf monitoring device
- Provides both arterial oxygen saturation and heart rate information
- Allows pilots to spot check their oxygen saturation during flight
- There are issues with this approach

In-Flight Finger Left Hand vs Right Hand Oximeter Data



Moving the Sensor North of the Heart: Arteries of the Face



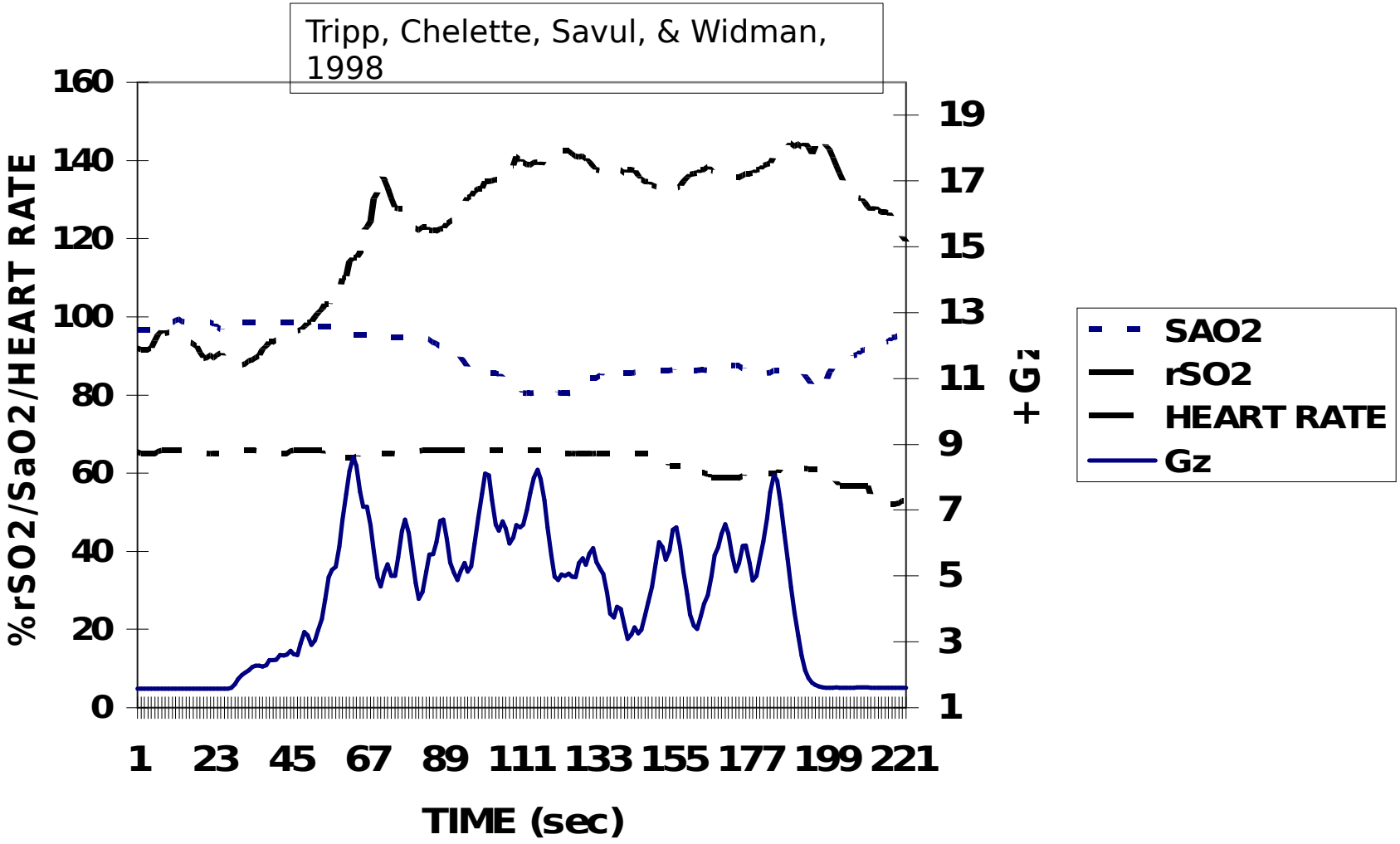
Helmet Ear Cup Integrated Pulse Oximetry 1990's

Peel and Stick Oxisensor

Silicon Ear Cup Integrated Oxisensor

Helmet Ear Cup Integrated Oxisensor: F-22 SAB 120 Day Challenge: 15 Nov 2011

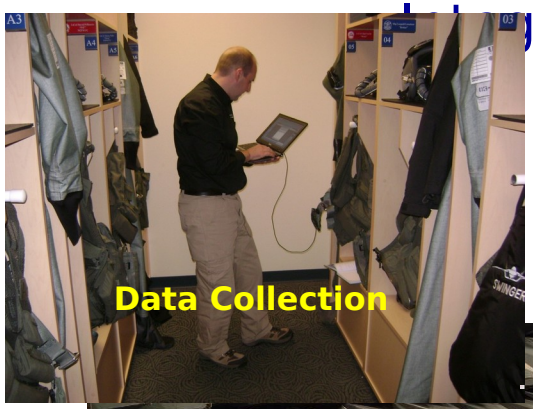
Helmet Mounted Cerebral and Arterial O2 Saturation During Simulated Aerial Combat Maneuver

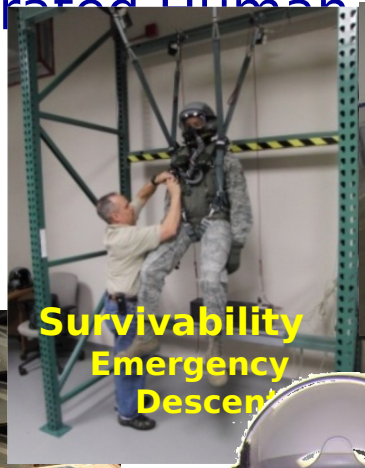


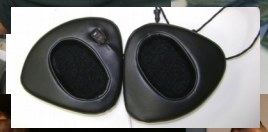
Helmet Mounted Pulse Oximeter:

RH + USAFSAM + HSI + NAMRU-D + F-22 SPO + AFRL/RY + Industry =

Integrated Human Performance Solutions







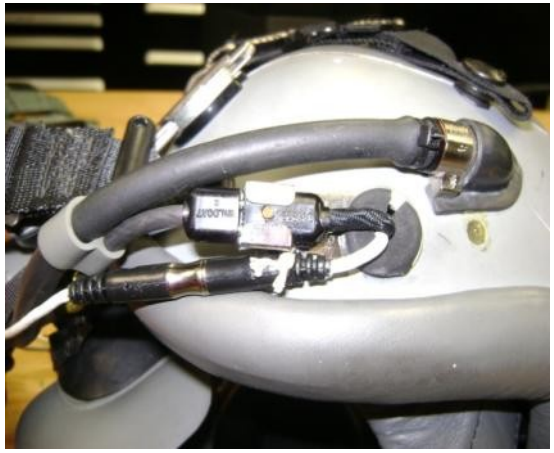
Helmet-Mounted Pulse Ox System Integration

WristOx Display

Cabling follows Comm Cord

In-line disconnects

Helmet Modification and Testing Begin November 2011



Flight Helmet Oximeter Wiring

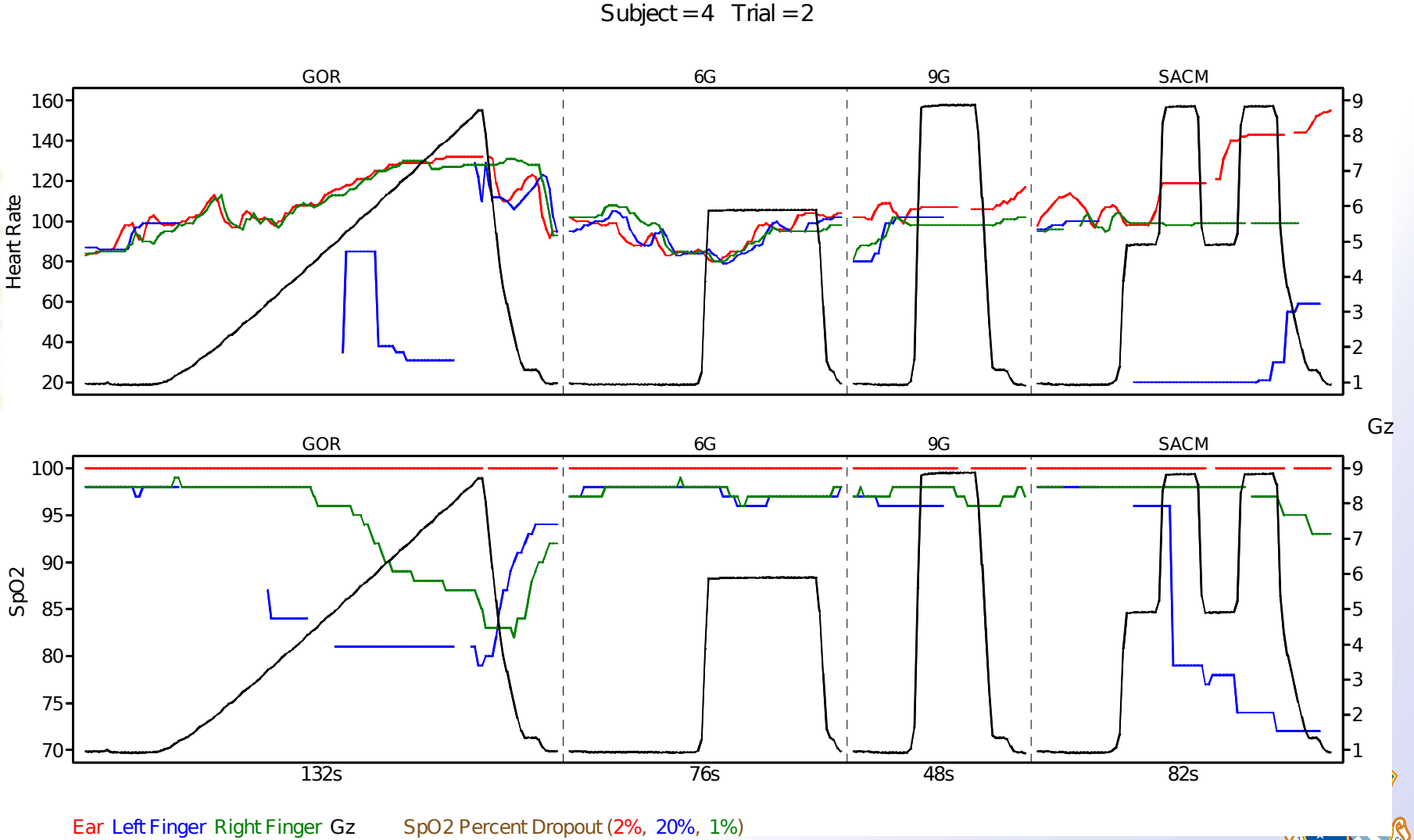
Parachute Harness Oximeter Pouch

Integrated Oximeter System

NVG System Compatibility Test

Helmet Centrifuge Testing December 2011

Centrifuge Tests Finger vs. Helmet



Hanging Harness Test at USAFSAM December 2011

Electromagnetic Interference Characteristics Test January 2012

Windblast Testing 600 Knots Equivalent Air Speed

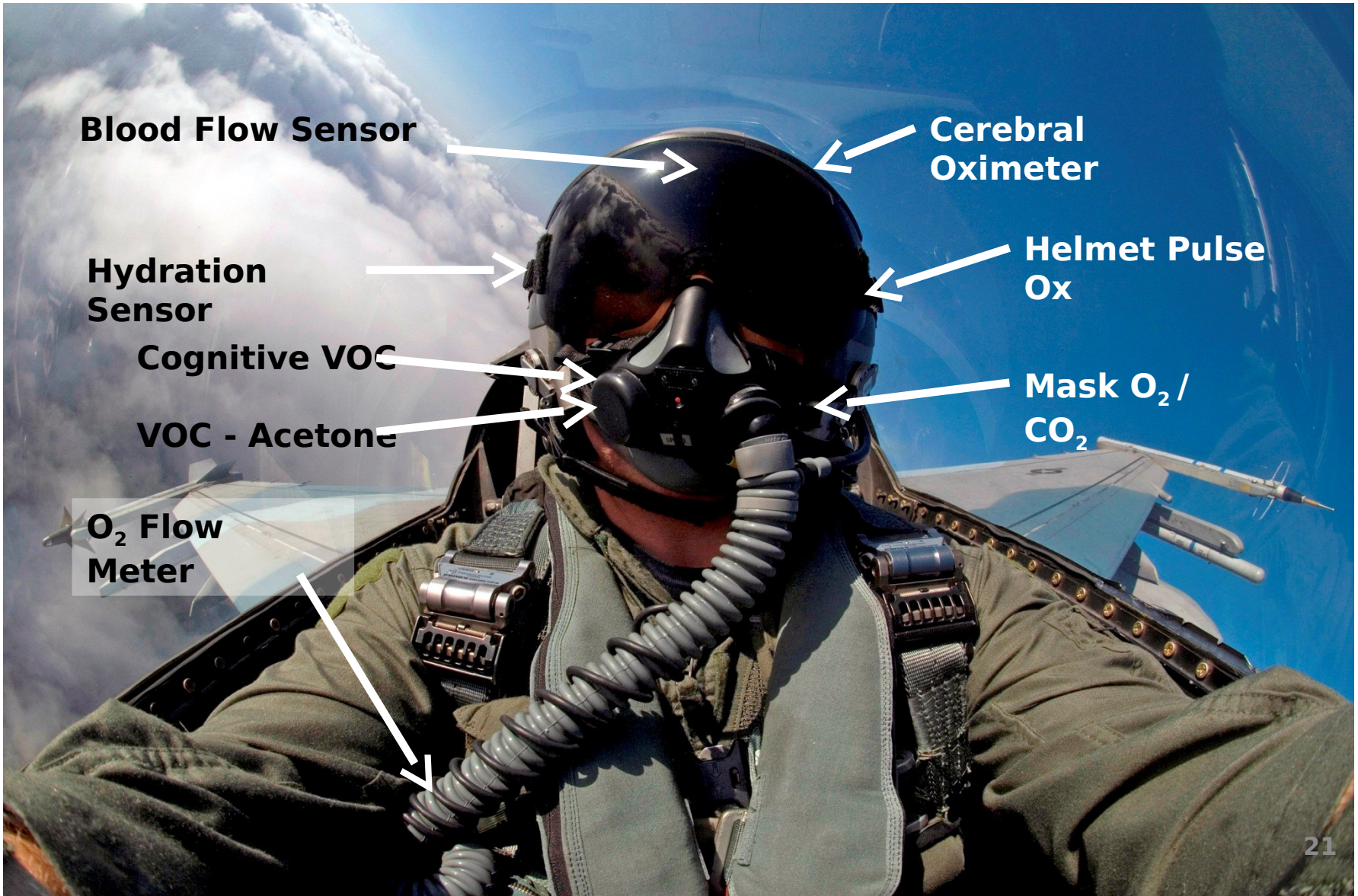
January 2012

Flight Test: Edwards & Nellis
7 February 2012

Flight Equipment Technicians Briefing Pilots on HMPO System

Helmet Mounted Pulse Oximetry
First Unit Equipped Apr 2012 – Last Unit Equipped Dec 2012

Tactical Aircraft Physiological & Cognitive Monitoring System (TAPCOMS)



Questions